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There are no rigid rules that can be established as to which type of suture material should be used in each and every situation. However, analysis of the wound and consideration of the chemical and physical characteristics of the suture and awareness of the biological reactions of the various suture materials will usually indicate one material to be superior.

The first decision that has to be made in wound repair is whether absorbable or nonabsorbable suture material should be used. Knowledge of both established and newer suture materials available to the veterinary surgeon should permit a more valid choice rather than using a material out of habit or what happens to be closest at hand.

Absorbable Suture

Catgut. Since catgut is sheep or beef submucosa, one can regard this suture material as basically a heterograft of collagen and like most heterografts will remain a variable length of time. A reduced absorption time is promoted in tissues with an abundant blood supply, sepsis, inflammation, and where naturally occurring enzymes are present such as in the pancreas, stomach and small intestines.

Chromic acid promotes cross-linking of the triple helix structure of collagen and prevents the access of tissue proteases. Tanning of collagen by chromic acid thus permits catgut to be slightly more predictable in absorption time and stronger for a longer period of time than (untanned) plain catgut. The intensity of soft tissue reaction is much greater from plain catgut however. All catgut swells because of absorption of water from surrounding tissues. Therefore longer ends must be left in knots since the swelling tends to loosen the knots.

Polyglycolic Acid. This completely synthetic material has been recently introduced. It causes little tissue reaction and is absorbed by slow hydrolysis to body metabolites. Catgut, on the other hand, is broken down by enzymatic degradation and phagocytosis. Polyglycolic acid is a braided multifilament and handles similar to silk. Its tensile strength during the lag and fibroplasia phase of healing is generally thought to be greater than catgut.

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Indications for Absorbable Suture. The major reason for absorbable material is related to its minimal bacteria-harboring properties. The interstices of multifilament nonabsorbable materials are notorius for affording an area for accumulation of devitalized tissue, blood and body fluids with subsequent bacterial proliferation. Absorbable suture is thus indicated in situations where contamination cannot be unequivocally eliminated.

Another indication for absorbable material is where a hollow viscus is entered which contains concentrated minerals or salts. It is generally thought that a nonabsorbable suture in such a viscus might form a nidus for stone formation. Absorbable materials are thus preferred for penetrating sutures of the gallbladder and urinary bladder.

Absorbable suture is recommended for the penetrating layer of a gastrointestinal closure since sterilization of the tract is never complete. Absorbable suture to close dead spaces resulting from extensive soft tissue wounds is indicated if contamination is minimal. It should be used with reservation in an infected or grossly contaminated soft tissue wound. The material may be either prematurely absorbed or in the case of catgut actually contribute to the suppurative process by its inflammatory nature. Absorbable material on the other hand would still be preferred to a multifiliment nonabsorbable suture such as silk or cotton.

A select number of nonabsorbable materials are preferred to absorbable suture in situations where contamination is present but where any compromise in tensile strength could be deleterious or even disastrous. For example, use of monofilament stainless steel for abdominal closure following an intestinal anastomosis has a much lower incidence of dehiscence than the use of absorbable material.

Absorbable suture has been successfully used for deep sutures in hepatic, renal and splenic wounds as well as ligation of ovarian and uterine stumps. Absorbable material is commonly used as a continuous subdermal stitch. Plain catgut would be contraindicated, however, due to its intense tissue reaction underlying the skin.

Nonabsorbable Suture

Over the past few years there has been a gradual swing of preference to nonabsorbable materials. Nonabsorbable materials are indicated when high tensile strength and/or low tissue reactivity are desirable. There are both monofilament and multifilament materials available. Monofilament nonabsorbable suture is more difficult to handle and to hold knots with than multifilament material. The latter material, however, has greater tissue reaction and a higher incidence of infection. Nonabsorbable suture can be divided into three basic types. These are natural fibers (e.g. silk), metals, and synthetics (e.g. nylon, polyester).

Natural Fibers. Silk was the first nonabsorbable suture material used and it is still popular. Since it is multifilament its chief advantage is ease of handling, ability to hold knots, and a relatively low tissue reactivity. Silk can be used for esophageal surgery, closure of the seromuscular layer of the gastrointestinal tract, reproductive tract and urinary bladder, blood vessel ligation, pulmonary lobectomy, nerve and tendon repair, diaphragm surgery, pancreatic surgery, corneal surgery etc. Silk, until recent years was universally used in cardiovascular suturing, however, the newer synthetics are being used increasingly because of their strength and small size.

Silk should not be used in superficial soft tissues which may be contaminated. Small abscesses may develop and fistulate or "spit" until the suture material is removed from the body. In some cases silk may excite a foreign body reaction and eventually extrude. Silk should definitely not be used in infected wounds since the interstices formed by the fibers permit a refuge for bacteria. Cotton has much the same advantages, shortcomings, and indications as silk.

Metals. Both monofilament and multifilament sutures are available. Stainless steel wire is quite inert and has the least tissue reaction of any suture material. The relatively smooth surface of monofilament wire also reduces the ability for bacteria to flourish upon it. However, even the most highly polished surface has an

irregular surface in which some bacteria can find sanctuary. The major disadvantage of monofilament wire is its difficulty in handling and knotting. Square knots should be used rather than just twisting the ends.

The primary advantage of multifilament wire is its greater ease of handling. It should not be used in infected wounds because of the possibility of infection among the interstices.

Stainless steel wire is commonly used in bone and tendon surgery, abdminal closure, contaminated soft tissue wounds and routine skin closure.

Synthetics. Nylon is strong and inert, but it is difficult to handle and knot. Nylon tends to straighten out or unkink after loops have been formed during development of the knot. Consequently a double reef knot is often necessary to secure the knot. It is usually used primarily for skin closure.

Vetafil (polymerized caprolactum) is composed of twisted synthetic fibers enclosed within a smooth "proteinacious" outer coat. There is little information in the English literature as to the exact composition of the twisted fiber and the "proteinacious" outer coat. Nevertheless it is somewhat of an intermediate in tissue reactivity when compared to synthetic monofilament and synthetic braided materials.

Vetafil has had wide appeal to veterinary surgeons. Its limitations are that it is difficult to handle when heat sterilized and cannot be used for delicate surgery. Chemical sterilization does not render the material sufficiently sterile to be safely buried. Under aseptic conditions, heat sterilized Vetafil can be used in ovariohysterectomies, abdominal closures, and such orthopedic procedures as parapatellar tissue imbrication, and closure of gluteal muscle tenotomies.

Polyester fibers are popular braided materials used today in human surgery and used increasingly in veterinary surgery. Braided polyester fiber holds well but does cause the most tissue reaction of the synthetic suture materials. It is still less irritating than cotton or silk however. Teflon suture itself is very inert but has poor knot retention and the cut ends tend to fray. More recent suture materials have been the combination of Teflon with polyester. Teflon coating makes the suture material more slippery than silk, although, some polyester Teflon suture materials are texturized to handle like silk cotton. It is recommended that additional knots be placed when using Teflon coated or impregnated suture material.

Indications for a polyester-Teflon suture material are much the same as for silk or cotton. The polyester-Teflon materials and especially the "monofilament-like" types can be placed in more superficial soft tissues than silk or cotton with much less risk of suture infection.

One decision which the surgeon must make is the size of the suture material to be used. In general one should never use a larger size than the strength of the tissue dictates. A general guide would be the following:

Skin	3–0 to 4–0
Dermal layer and subcutaneous fat	3–0 to 4–0
Thin skin, skin grafts	4–0 to 5–0
Fascia	–0 to 3–0
Muscle	2–0 to 3–0
Ligation of small vessels	3–0 to 4–0
Ligation of large vessels and pedicles	–0 to 2–0
Suture of kidney and liver	–0 to 2–0
Suture of alimentary and urogenital tract	3–0 to 5–0
Suture of blood vessels	3–0 to 5–0
Suture of nerves	5–0 to 6–0

To convert monofilament stainless steel to the above:

40 gauge	6–0
36 gauge	5–0
33 gauge	4–0
30 gauge	3–0
28 gauge	2–0
26 gauge	–0

Of major concern to the veterinary surgeon is the relative costs of materials used during the surgical procedure. It is on this basis that a realistic professional surgical fee should be determined. The cost of suture materials along with disposable gowns, gloves, caps, masks, instrument depreciation and anesthetics should all be taken into consideration.

To reduce the number of variables in determining suture costs the following criteria were established. Data was obtained from recent catalogues of various suture manufacturers. In situations where each company produced the same product the median price was obtained. Discount prices or "specials" were not considered. (Chart 1)

Absorbable suture costs are based on an order of 12 units or more of 2–0, 27 inch cut lengths in boxes of 36. Figures for nonabsorbable materials are based on an order of 12 units or more of 2–0, nonsterile, 100 yard spools. Exceptions to these criteria are explained under the comment column.

From the data presented it is evident that nonabsorbable material is much less costly than absorbable material. It should be noted that when suture material is purchased in less than 12 units there is usually a 40 to 50% increase in cost. For example, an individual jar of twelve 20 inch strands of 2–0 chromic catgut would cost 48 to 68 cents per yard depending on the manufacturer.

Suture Material	Proprietary Name Where Applicable	Comment	Approximate cost/yd.
Chromic Catgut			24¢
Polyglycolic Acid	Dexon (Davis & Geck)	Can be purchased at this cost in less than 12 units.	42¢
Silk (Black)			6¢
Cotton (White Twisted)			6¢
Stainless Steel (Monofilament)		Can be purchased at this cost in less than 12 units. Smaller gauge wire such as used for skin sutures is 50% less costly.	8¢
Stainless Steel (Multifilament)		Can be purchased at this cost in less than 12 units. No marked cost reduction with smaller gauge wire.	12¢
Nylon (Monofilament)	Ethilon (Ethicon)	Can be purchased at this cost in less than 12 units.	3¢
Polymerized Caprolactum	Vetafil (Jackson)	Cost based on 164 ft. spool.	8¢
Braided Dacron	Mersilene (Ethicon)		6¢
Teflon—Polyester	'cottony' Dacron (Deknatel)		6¢
Teflon—Polyester	'silky' Polydek (Deknatel)		6¢
Teflon—Polyester	Tevdek (Deknatel)		7¢